

LIFE IN WEIGHTLESSNESS

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## LIFE IN WEIGHTLESSNESS

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The study of medical-physiological problems confronting man /2190\* in space was one of the main subjects of the 42nd Congress of the Aerospace Medical Association (Houston, 26-29 April 1971).

During extended space flights, weightlessness can lead to various organic disorders. Vetter, Sullivan and Hyatt explored with apexography the left ventricular function that was found perturbed in 11 individuals laying in bed for a long period of four weeks under a simulated weightless condition. This supports their previous studies which have demonstrated a lesser increase of cardiac output under stress when physical exertion is preceded by an extended stay in bed. While the drop in plasmatic volume usually occurs during the week after leaving the bed, the apexogram anomalies remain longer. Griffith subjected five paraplegic and two polytraumatized individuals to a lengthy stay in bed, with a sodium-free diet and a salidiuretic treatment with hydrochlorothiazide, which resulted in the reduction of sodium content by 58% and of calcium content by 53%. As only 10% of the calcium that filters through the glomerule reaches the distal nephron, 90% of the calcium reabsorption is independent of the parathormone. This suggests that calcium reabsorption is influenced by sodium and extracellular volume. One should further explore to avoid calcium hyperdeficiency, demineralization and urinary lithuasis during extended stays in bed and weightlessness.

Wamsley and Miller studied four individuals during a 90-day

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\*Numbers in the margin indicate pagination in the foreign text.

stay in a space cabin simulator with an atmospheric pressure of 517 mm/Hg, a partial  $\text{CO}_2$  pressure varying from 2.8 to 11.3 mm/Hg, and a complete biological isolation. Two of the four individuals were a night team, sleeping during the day. During the entire duration of the experiment, numerous blood, urine, lung, cardiac, bacteriological and psychological parameters were gathered. The crew was doing regular physical exercises on an ergometric bicycle. Under these conditions the authors didn't observe any special medical problem; 7 and 10 days were required for the two individuals to adapt themselves to the night work routine. The varying  $\text{CO}_2$  levels do not result in an obvious modification of the acid-basic equilibrium. However, a hypercalcemia appears to coincide with the high  $\text{CO}_2$  partial pressures in the inhaled air. Seeman, McLean and Okanes placed four individuals for 90 days in a space simulator and observed their behavior by television; they had radio communications with the outside, analogous to those in a space flight, and were subjected to various psychological tests. Hostility phenomena were observed among crew members, but with no consequences as each one withheld his grievances in order to assure the mission success. The work of the crew was carried out perfectly but there was practically no human communication among the individuals; this was particularly obvious after the 60th day. During the same 90-day period Jackson has successfully tested various equipment required for the full biological autonomy of the four individuals: production of drinking water from urine and ambient humidity, treatment of waste water for repeated use for body hygiene, oxygen recovery from  $\text{CO}_2$ , use of radioisotopes as source of thermal energy, crew capability to maintain and repair equipment during flight.

Skylab, the future space station is to be launched by NASA for an 8-month orbital mission with manned phases from 28 to 58 days by means of the space rendezvous technique. The living space is divided in four rooms: experiments room, sleeping quarters, waste treatment room, living room. The ambient temperature can

vary from 16 to 32°C, humidity from 0.018 (specific) to 90% (relative). The acoustic environment should not exceed a sound level of 75 dB. The lighting, different from room to room, is designed according to needs. Sleeping is in sleeping bags with zippers allowing anchoring the astronauts in weightlessness. The diet of the occupants approximates that of home-cooking as much as possible. There is no laundering aboard; the occupants will have a sufficient supply of clothing and underwear. Toilets are, of course, provided (usable in all positions), as well as a bathroom. A vacuum cleaner will be available for cleaning. There will be also social games, books and music.

Thus, by supplementing the information obtained through Apollo missions, NASA continues its laboratory research as a prelude to the next phases of the space conquest.